2020

ELECTRONICS — GENERAL

Paper : DSE-A-1

(Semiconductor Devices Fabrication)

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Day 2

Answer ***question no.*** **1** and ***any four*** from the rest.

1. Answer ***any ten*** questions : 1×10

(a) Bandgap of semiconductor is

(i) more than insulator (ii) less than conductor

(iii) less than insulator (iv) same as insulator

(b) Point defects are known as

(i) equilibrium defect (ii) line defect

(iii) small defect (iv) tiny defect.

(c) Amorphous material has

(i) long range atomic order (ii) short range atomic order

(iii) no atomic order. (iv) very short range atomic order.

(d) Czochralski growth method is used to grow

(i) polycrystalline Si (ii) amorphous Si

(iii) Si thin film (iv) single crystal Si.

(e) Diffusion pump is categorised as

(i) primary pump (ii) secondary pump

(iii) cryo pump (iv) molecular pump.

(f) Pirani gauge is used to measure

(i) temperature (ii) vacuum

(iii) intensity (iv) surface roughness.

(g) MBE is method to grow

(i) Polycrystalline layer of a material (ii) Amorphus layer of a material

(iii) Epitaxial layer of a material (iv) Bulk amount of Si.

(h) Ion implantation is primarily used for

(i) Doping (ii) Imaging

(iii) Isolation (iv) Defect removal.

(i) Depletion MOSFET can be used in

(i) Depletion mode only

(ii) Enhancement mode only

(iii) Both enhancement and depletion mode

(iv) None of the above.

(j) CMOS device is widely used as it

(i) consumes small power (ii) consumes large power

(iii) is very light weight (iv) is very economic.

(k) Photolithography is used to

(i) pattern the substrate (ii) etch the substrate

(iii) heat the substrate (iv) melt the substrate.

(l) MEMS stands for

(i) Mega Electric Mechanical System

(ii) Manual Electric Mechanical System

(iii) Micro Electro Mechanical System

(iv) Miniature Electro Mechanical System.

2. (a) Differentiate metal, semiconductor and insulator by drawing energy band diagram.

(b) Name the different kinds of defect appear within crystal.

(c) Briefly describe the Czochralski method to grow Si with proper diagram. 3+2+5

3. (a) Why vacuum pump is needed in thin film growth?

(b) Explain the basic working principle of a diffusion pump with a neat diagram.

(c) Describe the CVD process for the growth of Si. 2+4+4

4. (a) Differentiate between thermal evaporation and sputtering processes.

(b) What is meant by Passivation?

(c) Describe the ion implantation process in brief. 3+2+5

5. (a) Why etching is needed for device fabrication?

(b) Differentiate between dry and wet etching.

(c) Explain briefly the MBE system with proper diagram. 2+3+5

6. (a) What is the need of photolithography in case of device fabrication?

(b) Differentiate between positive and negative photolithography.

(c) Discuss comparatively the contact printing, proximity printing and projection printing schemes. 2+3+5

7. (a) What is the need of oxidation in device fabrication process?

(b) Briefly discuss the dry and wet oxidation.

(c) Draw the C-V characteristics of MOS capacitor and indicate different regions of it. 2+5+3

8. (a) Why reactive ion etching (RIE) is required for semiconductor device fabrication?

(b) In which case electron beam lithography is preferred than photo lithography?

(c) Explain briefly the fabrication process of a PNP transistor. 2+3+5

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